

DRAWINGS ATTACHED

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(4) IMPROVED DISPENSING DEVICES FOR USE WITH OR INCLUDING AEROSOL DISPENSING CONTAINERS

- (71) We, RICE LABORATORIES INC., a Corporation organized and existing under the laws of the State of Delaware, United States of America, 19001 Northford Street, Northridge, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to a dispensing device which is particularly suited for dispensing and administering measured amounts of fluids. The principal use for such a device is in dispensing measured amounts of a medicament-containing aerosol for inhalation therapy.
- The invention provides a dispensing device for use in combination with an aerosol dispensing container charged with a self-propelling liquid composition, and equipped with a metering valve including a valve stem formed with a discharge tube, which valve stem is mounted for movement relative to the container between an open charging and an inner discharging position for said metering valve, and comprising: a housing for receiving said container for reciprocation of said container within said housing, said housing including a support member having an opening for receiving said discharge tube and providing a discharge passage for said tube; a spring means carried in said housing for urging said container toward said discharging position, the spring means being compressible to a cocked position permitting movement of said valve to said charging position and movement of said container away from said support member; a latch for locking said spring to said cocked position; and a trigger for tripping said latch to release said spring means to urge said valve to said discharging position.
- According to a feature of the invention said spring means is positioned at the end of said housing opposite said support member, and the

dispensing device includes manually actuatable means for applying a force to said container for compressing said spring to said cocked position.

The manually actuatable means may include first and second portions of said housing movable relative to each other, with said support member to said first portion and said spring in said second portion.

Alternatively the manually actuatable means may include a lever arrangement engageable with said container and push rod engaging said lever arrangement and projecting exteriorly of said housing.

According to another feature of the invention, there is manually actuatable means for compressing said spring means to said cocked position, and said latch incorporating bias means urging the latch to the locking position.

In one form said housing includes means defining an air passage therethrough, and said trigger includes an element disposed in said air passage and movable therein to engage and trip said latch, with a pressure differential in said air passage across said element producing such movement.

In this form the air passage may include a tubular section, with said latch extending to said tubular section adjacent one end thereof, and in which said movable element comprises a buffer-like member displaceable in said tubular section to impact said latch under the influence of the pressure differential.

Alternatively said movable element may comprise a vane disposed in and substantially blocking said air passage, with a pressure differential moving said element to trip said latch.

According to yet another feature of the invention there is locking means movable between locked and unlocked positions when said latch is locking said spring means to said cocked position, with said locking means disposed when in said locked position to engage said latch blocking the tripping thereof.

- then, bringing the barrel opening 39 into the position of the housing 31. The measured charge of material within the housing 31 is discharged through the tubular end 38 of the stem of the valve.
- With the upper portion 22 of the housing removed, the container 20 is positioned in the lower portion 23, with the tubular end 38 of the valve stem entering a support member 43 projecting upward from the bottom of the housing. A discharge passage 44 is provided in the member 43 for communication between the valve and the mouthpiece 45 of the housing. Role 46 may be provided within the lower portion 23 of the housing for spacing the container from the housing providing an air passage around the container. The container is preferably but not necessarily removable and replaceable.
- A spring system is carried in the upper portion 22 of the housing for engaging the container 20 and urging the container downward in the discharging position of Figure 2. The spring system is best seen in Figures 3 and 4 and includes a coiled spring 47 and a fixed element 48 with springs 49, 50 carried in openings in the moving element 47 and engaging the fixed element 48. A latch member 51 is pivotally mounted to the fixed element 48 as a pin 52 and includes a hook 53 for engaging a notch 54 of the moving element 47 (Figure 3). A small spring 55 disposed between the hook 53 and the fixed element 48 urges the lower lever 51 and the fixed element 48 upon the lower lever toward the locking position.
- An arm 60 of the latch lever 51 projects through an opening 62 of the housing into a tubular passage 63, the passage 63 preferably being moulded as a part of the upper portion 22 of the housing (Figure 4). The upper end of the passage 63 is closed by a plug 64 and a member 65 is positioned across the lower end of the passage. A trigger member 66 is positioned in the passage 63 and a preferred buffer-shaped flange 67 for the trigger member is shown in Figure 9. A rounded head 67 substantially fills the passage 63 and vane or flange 68 function to actuate the member 65 in the passage 63.
- The plug 64 in the preferred embodiment is movable between an open or unloading position and an off or locking position, with a finger 70 riding in an arcuate groove 71 in the upper housing portion 22 for limiting the motion (Figure 1). When in the open position, a notch 72 in the lower end of the plug 64 is aligned with the latch lever 51 (Figure 6), permitting upward movement of the latch lever. When in the off position, the groove 72 is moved to the position of Figure 4 for locking movement of the latch lever 51.
- In considering the operation of the device, first with the mechanism in the position of Figure 2 as it is immediately following the discharge of a measured amount of material from the container. The housing is manually

compressed, so by placing the thumb at the bottom and the fingers at the top of the housing. The moving element 47 is moved to the position of Figure 3, so compressing the springs 49 and 50. The hook 53 of the latch lever engages the notch 54 of the moving element, thus cocking the spring system. The manual compression force is now released and the container is moved to the charging position of Figure 4 with the spring 36 of the valve acting to move the container upward with respect to the lower portion 23 of the housing. The device is now cocked and locked and the metering valve is charged. If desired, the plug 64 may be moved to the off or locking position. When the patient is ready for a dose, the locking device is turned to the on position and the mouthpiece 45 is positioned in the patient's mouth.

There is an air passage through the device starting at the bottom of the tubular passage 63, through the opening 62 into the upper portion 22 of the housing, around the container 20 to the lower portion of the housing and out through the mouthpiece 45. When the patient starts to inhale, a pressure differential is produced across the trigger member 66, causing the trigger member to fly upward and impact the arm 60 of the latch lever 51, as shown in chain dotted lines in Figure 2. This impact trips the latch lever and releases the moving element 47. The compressed springs 49 and 50 act through the moving element 47 to move the container 20 downward from the position of Figure 4 to the position of Figure 2, discharging the measured dose through the passage 44 into the mouthpiece 45 for inhalation by the patient, thereby completing the cycle of operation of the dispensing device.

An alternative form of the dispensing device is illustrated in Figures 10 and 11, with the container 20 carried in a one-piece housing 73 having the general configuration of the housing of the other embodiment. The container is inserted through the open top of the housing, with the tubular end 38 of the valve stem entering the support member 43. A spring member 76 is positioned over the container and a cover 77 is threadably inserted into the top opening of the container. The spring member 76 typically may be a plastic ball or an oiled metal spring.

A push rod 80 is slidably positioned in aligned openings 81 and 82 of the housing. Levers 83 and 84 are pivotally carried at the inner end of the push rod 80, with one lever engaging the bottom of the housing and the support member 43. A latch pin 85 is disposed in the housing for sliding transverse to the axis of the push rod 80, between the housing position of Figure 10 and the extended position of Figure 11.

An air passage is provided through the de-

- The invention also provides a dispensing device having a housing, an aerosol dispensing container carried in said housing and charged with a self-propelling liquid composition; metering valve means coupled to said container and movable between a charging position for receiving a charge from said container and a discharging position for dispensing said charge; said housing including first and second portions displaceable relative to each other; a spring means carried in said housing between said first portion and said container for urging said container against said second portion and said metering valve means to said discharging position, said first and second portions being movably compressible for compressing said spring means to a cocked position for movement of said metering valve means to said charging position; a latch for locking said spring means in said cocked position; said housing including means defining an air passage therethrough with a tubular section, with said latch extending into said tubular section adjacent one end thereof; and a trip element slidably disposed in said tubular section to impact said latch under the influence of a pressure differential in said air passage for tripping said latch to release said spring means, and so urging said metering valve means to said discharging position.
- The invention also provides a dispensing device having a housing, an aerosol dispensing container carried in said housing and charged with a self-propelling liquid composition; metering valve means coupled to said container and movable between a charging position for receiving a charge from said container and a discharging position for dispensing said charge; a spring means carried in said housing for urging said container and the metering valve means to said discharging position; a manually actuatable push member carried in said housing and engaging said container for moving same to a cocked position for movement of said metering valve means to said charging position; a latch engaging said push member for locking said spring means to said cocked position; said housing including means defining an air passage therethrough with a vane member disposed in and substantially blocking said air passage and coupled to said latch, the arrangement being such that a pressure differential in said air passage across said vane member is to trip said latch and release said spring means, and so urging said metering valve means to said discharging position.
- Two specific embodiments of the invention will now be described by way of example with reference to the accompanying drawings, of which:—
- Figure 1 is a view from above of a preferred embodiment of the dispensing device of the invention.
- Figure 2 is a sectional view taken along the line 2-2 of Figure 1 showing the device in the discharging position.
- Figure 3 is a view similar to that of Figure 2 showing the device at the completion of the cocking operation.
- Figure 4 is a view similar to that of Figure 2 and 3 showing the device cocked and locked and ready for tripping.
- Figure 5 is a partial sectioned view taken along the line 5-5 of Figure 4.
- Figure 6 is a sectional view taken along the line 6-6 of Figure 4.
- Figure 7 is a sectional view taken along the line 7-7 of Figure 4.
- Figure 8 is a partial view similar to Figure 6 showing the device in the locked or off position.
- Figure 9 is an isometric view of a preferred trigger means of the device of Figure 1 to 4.
- Figure 10 is a sectional view similar to that of Figure 4 showing an alternative embodiment of the device in the cocked and locked position; and
- Figure 11 is a view similar to Figure 10 showing the device in the discharging position.
- Referring first to the device of Figure 1 to 4, a container 20 is positioned within a housing 21 consisting of an upper portion 22 slidably disposed over a lower portion 23. The housing portions may be made of plastic material, at least one portion being relatively flexible, and so permitting the other portion to be pushed thereover to the position of Figure 2. The two portions have interengaging grooves 34 and 35 and shoulders 26 and 27, permitting telescoping sliding between the portions of Figures 2 and 3.
- The container 20 may be an aerosol dispensing container such as is described in U.S. Patent Specification No. 3,003,534. A metering valve 30 is incorporated in the container 20 and includes a stem 31 movable relative to the container between an outer charging position (Figure 4) and an inner discharging position (Figure 2). A valve housing 32 is fixed to the end of the container 20 with a gasket 33 at the container opening. Another gasket 34 and a plate 35 are positioned at the other end of the housing 32. A spring 36 is positioned about the stem 31 and is compressed between the plate 35 and a shoulder 37 of the stem. The stem 31 is formed with a tubular outer end 38 providing a discharge tube with a barrel opening 39.
- When the valve is in the charging position of Figure 4, a measured quantity of fluid from the container 20 flows into the valve housing 32 around the reduced lower end of the stem 31. Engagement of the shoulder 37 with the gasket 33 prevents discharge from the container. For discharging, the spring 36 is compressed to the position of Figure 2, bringing the shoulder 40 of the pin 31 into sealing engagement with the gasket 34 and at the same

- time, starting at an opening 83, with a section of relatively large cross-sectional area compared to the bottom of the air passage and formed by a shoulder 85. The passage leads into a chamber 86, and around the support member 43 to the mouthpiece 45. A plate or vane 93 is supported in the passage formed by the shoulder 85 by resilient members 94. Levers 95 and 96 are pivotally mounted on a base 97 carried on the lower side of the vane 93, with the lever 95 engaging the housing and the lever 96 pivotally connected to the latch pin 85.
- The dispensing device is shown in the discharging position in Figure 11. After discharge, the push rod 80 is manually pushed inward from the position of Figure 11 to the position of Figure 10, with the action of the levers 83, 84 moving the member upward and compressing the spring member 76. A reduced section 99 of the push rod is brought into alignment with the latch pin 85, permitting movement of the vane 93 to the position of Figure 10 under the action of the resilient members 94. This movement of the vane produces an upward movement of the latch pin 85 to the position of Figure 10, thereby locking the mechanism in the cocked position.
- The dispensing device is now ready for discharging a measured charge. The patient places the mouthpiece 45 in his mouth and starts to inhale. The initial inhalation produces a pressure differential across the vane 93, moving the vane to the right to the position of Figure 11, thereby tripping the latch so that the spring member may move the container down to the discharging position and discharge the measured dose into the mouthpiece.
- The vane 93 has a relatively large cross-sectional area and is required to travel only a very short distance in order to trigger the latch and is in order to open the air passage. This arrangement provides a very sensitive device which is triggered with a very low pressure differential providing accurate and steady the exact amount of communication of substance while also insuring very little impedance into the air passage, the latter being of particular importance with weak patients. The base 97 engages the housing as shown in Figure 11, thereby limiting the travel of the vane 93 during the tripping operation. It is desirable to have an open air passage through the device after discharging a charge so that continued inhalation by the patient will overcome the aerosol from the passage 44 and mouthpiece 45 and so that the device will introduce a minimum impedance to second breathing.
- The device may be designed to provide this open air passage by allowing air flow around the vane 93 when the latch is in the extended position of Figure 11. Alternatively (as is indicated), the push rod may have a hole fit in the opening 81 permitting air flow through the opening 81 except when the mechanism is in the

latch position with sealing ring 100 engaging the housing 73 around the opening 81.

WHAT WE CLAIM IS:—

1. A dispensing device for use in combination with an aerosol dispensing container charged with a self-propelling liquid composition, and equipped with a metering valve including a valve stem formed with a discharge tube, which valve stem is mounted for movement relative to the container between an outer charging position and an inner discharging position for said metering valve, and comprising: a housing for receiving said container for reciprocation of said container within said housing, said housing including a support member having an opening for receiving said discharge tube and providing a discharge passage for said tube; a spring means carried in said housing for urging said container toward said discharging position, the spring means being compressible to a cocked position permitting movement of said valve to said charging position and movement of said container away from said support member; a latch for locking said spring to said cocked position; and a trigger for tripping said latch to release said spring means to urge said valve to said discharging position.
2. A device as claimed in claim 1 in which said spring means is positioned at the end of said housing opposite said support member, and including manually actuatable means for applying a force to said container for compressing said spring means to said cocked position.
3. A device as claimed in claim 2 in which said manually actuatable means includes first and second portions of said housing movable relative to each other, with said support member in said first portion and said spring means in said second portion.
4. A device as claimed in claim 2 in which said manually actuatable means includes a lever arrangement engageable with said container and a push rod engaging said lever arrangement and projecting exteriorly of said housing.
5. A device as claimed in any one of the preceding claims and including manually actuatable means for compressing said spring means to said cocked position, and said latch incorporating bias means urging the latch to the locking position.
6. A device as claimed in claim 5 in which said housing includes means defining an air passage therethrough, and said trigger includes a member disposed in said air passage and movable therein to engage and trip said latch, with a pressure differential in said air passage across said element producing such movement.
7. A device as claimed in claim 6 in which said air passage includes a tubular section, with said latch extending into said tubular section adjacent one end thereof, and in which said movable element comprises a buffer-like member displaceable in said tubular section to impact said latch under the influence of the pressure differential.

number of the said valve means to im-
pact said back under the influence of the pres-
sure differential.

8. A device as claimed in claim 6 in which
said movable member comprises a valve dis-
posed in said substantially blocking said air
passage, with a pressure differential moving
said member to open said back.

9. A device as claimed in any one of claims
1 to 7 and including locking means movable
between locked and unlocked positions when
said back is latching said spring in said coiled
position, with said locking means disposed
wherein to said locked position to engage said
back blocking the tripping thereof.

10. A dispensing device having a housing,
an actuating member carried in said
housing and charged with a self-propelling
liquid composition, metering valve means
coupled to said container and movable between
a charging position for receiving a charge from
said container and a discharging position for
dispensing said charge, said housing including
first and second portions distal relative to
each other, a spring means carried in said
housing between said first portion and said
container for urging said container against said
second portion and said metering valve means
to said discharging position, said first and sec-
ond portions being mutually incompressible for
compressing said spring means to a coiled po-
sition for the movement of said metering valve
means to said charging position, a back for
latching said spring means in said coiled po-
sition, said housing including means defining an
air passage therethrough with a tubular section,
with said back extending into said tubular sec-
tion adjacent one end thereof, and a trip dis-
posed distally disposed in said tubular section
to impact said back under the influence of a

pressure differential in said air passage for
tripping said back to release said spring
means, and so urging metering valve means to
said discharging position.

11. A dispensing device having a housing,
an actuating member carried in said
housing and charged with a self-propelling
liquid composition, metering valve means
coupled to said container and movable between
a charging position for receiving a charge from
said container and a discharging position for
dispensing said charge, a spring means carried
in said housing for urging said container and
the metering valve means to said discharging
position, a manually movable push member
carried in said housing and engaging said con-
tainer for moving said container and compress-
ing said spring means to a coiled position for
movement of said metering valve means to
said charging position, a back engaging said
push member for latching said spring means
in said coiled position, said housing including
means defining an air passage therethrough
and a valve member disposed in said substan-
tially blocking said air passage and coupled
to said back, the arrangement being such that
a pressure differential in said air passage
moves said valve member to open said back and
release said spring means, and so urge said
metering valve means to said discharging po-
sition.

12. A device substantially as hereinbefore
described with reference to and as shown in
Figures 1 to 9, or in Figures 10 and 11 of
the accompanying drawings.

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